April 2020





Overview

For healthcare drug delivery devices, like infusion pumps or insulin pumps, exact dosing is crucial. Thus, measurements of real drug delivery amounts plus exact control of dosing motors are required. Motors are typically three-phase BLDC types with a few watts (e.g. using 12V). For flow sensing, a factory-calibrated sensor or custom sensors may be used. Bluetooth® communication may also be needed to provide an up-to-date GUI via smartphone and additional interfaces, like Ethernet or a (medical-grade) isolated USB. Some end products may also require an uninterrupted power supply (e.g. using Li-ion cells).

Software following the ISO12207 standard can dramatically reduce time-to-market and development costs. Renesas provides this through its <u>Synergy Software Package</u>.

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System Benefits

- Supports infusion pump and insulin pumps
- Motor control for brushless DC motors (BLDC) or permanent magnet synchronous motors (PMSM) with analog or hall sensors/encoders, optional gear (also with high gear ratio)
- Flow measurement options: Integrated sensor or MCU-integrated analog front end (AFE) for custom sensor setup
- Communication: Bluetooth[®] 5, WiFi, Ethernet (e.g. for infusion pumps) and multiple serial interfaces for optional LTE-NB, isolated USB I/F, etc.
- HMI: LCD (for infusion pump) and touch and/or gesture control, also for sterile environment
- Battery management (e.g. optional 2x Li-ion cell for uninterrupted power supply)
- Synergy Software Package that follows ISO/IEC/IEEE 12207 standards (see next page for details)



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Compliance with ISO/IEC/IEEE 12207

- Synergy Software SDLC process is based on ISO/IEC/IEEE 12207
- Defines processes for development phases and the transitions between each phase
- Establishes common framework for software lifecycle process
- The core of a many significant safety, control, and medical device standards
 - Example: IEC 62304 used for medical device software
- Used by reputable organizations, such as the US Department of Defense and NASA



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SST

Drug Delivery with ISO12207 Software



Device Category	P/N	Key Features			
	S5D9	120MHz Arm® Cortex®-M4 integration with USB HS, Ethernet and TFT controller			
MCU	(or S7G2)	(or 240MHz Arm® Cortex®-M4 integration with USB HS, Ethernet and TFT controller)			
	RX23W	32 Bit, BT5.0 MCU with enhanced security			
Power	ISL9241	USB-C PD Li-ion battery charger for 2-4 cells			
	ISL85415	3-36V / 500mA output, buck regulator			
	ISL85403	2.5A regulator with integrated high-side MOSFET for synchronous buck or boost buck converter			
Apolog	HIP2103	60V, 1A/2A peak, half-bridge driver			
, malog	FSx012	Solid-state MEMS flow sensor module for liquids and gases			



ST

S5D9 – Synergy MCU with Rich SW Pack 120MHz Arm® Cortex®-M4F Integration with USB HS, Ethernet and TFT controller

120MHz Arm® Cortex[®]-M4F

- 1MB-2MB Flash + 640kB SRAM + 64kB Data Flash
- For mid-compute / performance-intensive, networked control applications with HMI
- Synergy Software Package SSP

Rich Interfaces

- TFT Controller w/ 2D Drawing Engine / Accelerator and JPEG decoder
- Capacitive Touch Sensing Unit
- Ethernet MAC Controller with DMA, IEEE 1588 PTP
- USB 2.0 High-Speed / Full-Speed, SDHI, Quad SPI, CAN 2.0, SCI (UART, Simple SPI, Simple I2C), SPI / I2C Multi-Master

Safety and Security features

Advanced analog features

Scalable from 100pin to 176pin packages

Part #	Memory	Temp. Range	Package
<u>R7FS5D97</u>	\rightarrow	\rightarrow	ightarrow See right



Memory

Bus



Arm Cortex-M4

System

Timers	Communication interfaces	Human machine interfaces
GPT32EH x 4 GPT32E x 4	SCI × 10 QSPI USBHS	CTSU Graphics GLCDC
GPT32 x 6	IIC × 3 SDHI × 2 ETHERC with IEEE 1588	DRW
AGT × 2	SPI × 2 CAN × 2	JPEG codec
RTC	SSIE × 2 USBFS	PDC
WDT/IWDT		

Event link	Data processing	Analog
ELC	CRC SRC	ADC12 with PGA × 2 TSN
Security	DOC	DAC12 ACMPHS × 6
SCE7		



S7G2 – Synergy MCU with Rich SW Pack

240MHz Arm® Cortex®-M4F Integration with USB HS, Ethernet and TFT controller

240MHz Arm® Cortex®-M4F

- 4MB Flash + 640kB SRAM + 64kB Data Flash
- For high-compute, performance-intensive, networked control applications with rich HMI
- Synergy Software Package SSP

Rich Interfaces

- TFT Controller w/ 2D Drawing Engine / Accelerator and JPEG decoder
- Capacitive Touch Sensing Unit
- Ethernet MAC Controller with DMA, IEEE 1588 PTP
- USB 2.0 High-Speed / Full-Speed, SDHI, Quad SPI, CAN Simple I2C), SPI / I2C Multi-Master

Safety and Security features

Advanced analog features

Scalable from LGA145 to BGA224 packages

Part #	Memory	Temp. Range	Package
R7FS7G27	\rightarrow	\rightarrow	ightarrow See right









RENESAS Synergy

ST SK-S

RENESAS Synergy

S7G2

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DK-S7G2

RX23W

Wireless Communication MCU Series within the RX Family

Bluetooth 5 + 54MHz / 32bit MCU with Enhanced Security

- BT5.0 full function
 - including Long Range (125/250kbps), 1Mbps, 2Mbps, Advertize Extensions & Mesh support
 - 2x higher communication rate + 4x longer distance

Integrated Security and Encryption Functions

- TSIP package
- Rich communication interface, like SD host interface, USB, CAN, Capacitive Touch I/F etc.
- Up to 512kB Flash and 64kB RAM, operating in broad voltage range 1.8-3.6 V

Excellent RF Performance

- RX sensitivity: up to -105dBm @125kps
- TX power: up to +4dBm

Part #	Enhanced Security	Package
R5F523WxADNG		56pin QFN, 7 x 7 x 0.4mm
R5F523WxBDNG	TSIP	56pin QFN, 7 x 7 x 0.4mm
R5F523WxADBL		85pin BGA, 5.5 x 5.5 x 0.5mm
R5F523WxBDBL	TSIP	85pin BGA, 5.5 x 5.5 x 0.5mm





BIG IDEAS FOR EVERY SPACE **RENESAS**

Solid-State MEMS Flow Sensor Module for Liquids and Gases

MEMS Thermopile Sensing for Gas or Liquid Flow

Fully calibrated and compensated flow

FS1012 / FS2012

- Robust solid isolation technology, resistant to vibration and pressure shock
- Food grade compatible version, easy cleaning and sterilization
- Fast response time + high sensitivity
- Silicon-carbide coating over MEMS flow sensor
- Digital (FS2012) or Analog output (FS1012)
- High accuracy (FS2012), typ. 2% of reading
- Low Power, 3V to 5V supply

Part #	Calibrated	Output	
<u>FS1012</u>		Analog	
FS2012	Yes	Digital	









HIP2103/4 – 60V, 1A/2A, Half-Bridge Driver

High Voltage Drivers for Industrial Motor Control

Optimized Half-Bridge Drivers

- Supports half-bridge, full bridge configurations
- Enables DC and 3-phase BLDC motors

Independent High/Low Inputs

- Reduces connections to MCU and lowers cost
- Supports 3.3V and 5V signals

Sleep Mode

- Low quiescent current (5uA) with unique sleep mode
- Allows direct connection to battery without disconnect switch

Integrated LDO (HIP2104)

- Option with integrated 12V & 3.3V LDO (HIP2014)
- Provides bias to external MCU

Part #	UVLO	VCC Reg	VDD Reg	Package
HIP2103FRTAAZ-T	4.0V	N/A	N/A	8L 3x3 TDF
HIP2104FRTAAZ-T	4.0V	3.3V	12V	12L 4x4 DFN







ISL85403 – 2.5A Regulator with Integrated High Side FET

Support 3V-40V Input Voltage Range for Buck or Buck-Boost Output

Wide Working Range

- Power input voltage range variable 3V to 40V
- Support both step down (buck) or buck-boost outputs
- Up to 2.5A load in temperature range

High Efficiency

- Optional external low side FET for higher efficiency
- Selectable PWM / PFM modes
- 300uA input quiescent PFM mode current
- Less than 5uA shutdown current

High Performance

- 200KHz to 2.2MHz frequency range
- +/- 1% voltage regulation accuracy

Part #	V _{IN} Range(V)	Temp.(°C)	Package
ISL85403FRZ-T	3 to 40	-40 to 125	20 Ld 4x4 QFN







ISL85403EVAL1Z Evaluation Board



ISL85415 – 0.5A Regulator with Integrated High Side FET Support 3V-36V Input Voltage Range for Buck Output

Wide Working Range

- Power input voltage range from 3V to 36V
- The device provides an easy-to-use high-efficiency, low BOM-count solution for a variety of applications.
- Up to 0.5A load over full temperature range

High Efficiency and Performance (Low Board Space)

- Synchronous operation for high efficiency
- No compensation required
- Integrated high-side and low-side NMOS devices
- Selectable PFM or forced PWM mode at light loads
- Internal fixed (500kHz) or adjustable switching frequency 300kHz to 2MHz

Part #	V _{IN} Range(V)	Temp.(°C)	Package
ISL85415FRZ	3 to 36	-40 to 125	12 Ld DFN 4x3







FIGURE 1. FRONT OF EVALUATION BOARD ISL85415DEM022



ISL9241 – Buck-Boost Battery Charger

Configurable Battery Charger with SMBus Interface and USB Power Delivery

Digitally Configurable Buck-boost Battery Charger

- Buck-boost charger for 2-, 3-, or 4-cell Li-ion batteries
- Input voltage range: 3.9V to 23.4V (no dead zone)
- System/battery output voltage: 3.9V to 18.304V

Different Charge Modes

- Narrow Voltage Direct Charging (NVDC)
- Hybrid Power Buck Boost (HPBB/Bypass) charging
- Switch between the modes is possible using firmware control
- Bypass mode is supported using a controller's firmware, allowing the adapter to provide power directly to the system.

Part #	Input Voltage Range	System/Battery Output Voltage	Temp.Range	Batteries	Package
ISL9241HRTZ	3.9V to 23.4V	3.9V to 18.304V	-10°C – 100°C	2-4	32 Ld 4x4 TQF
ISL9241IRTZ	3.9V to 23.4V	3.9V to 18.304V	-40°C – 100°C	2-4	32 Ld 4x4 TQF



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